REMARKS:

STATEMENT OF STATUS AND SUPPORT FOR ALL CHANGES TO THE CLAIMS
37 CFR 1.173(c)

The Examiner has requested that a statement of the status of all patent claims and of all added claims be submitted on a page separate from the pages containing the changes. Although such a statement was included on page 13 of the amendment submitted on June 13, 2005, the Applicant submits an updated statement out of an abundance of caution.

The Applicant submits that patent claims **1-29** are pending in this reissue application as of the date of this amendment.

The Applicant submits that claims **30-36** and **39**, which have been added in this reissue application, are pending in this reissue application as of the date of this amendment.

The Applicant submits that claims **37** and **38** which had been previously added in this reissue application have been canceled.

Support for the previous amendments to claim **1** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **6** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **10** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **13** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **14** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **18** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **19** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **20** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **21** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **22** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **23** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **24** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **25** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **26** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **27** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **28** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **29** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **30** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous and current amendments to claim **34** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for previously added claim **39** can be found FIG. 3J and in original claims **19-29**.

Support for newly added claim **40** can be found at col. 5, lines 32-33 and in original claim **2**.

NOTE ON CLAIM AMENDMENTS

Applicant has amended claims **18-29** and **34** to remove the word "cylindrical" before "fiber sockets". Applicant submits that this amendment, although it broadens the claims, does not raise an issue of recapture. Applicant submits that the prosecution history of the original application shows that the original claims as filed included the word "cylindrical". Furthermore, the prosecution history shows neither amendment nor argument by either Applicant or Examiner indicating that this feature was necessary to overcome the prior art during the prosecution of the original application. Consequently, these amendments represent a proper broadening reissue under 35 USC 251.

CLAIM OBJECTIONS

The Examiner has objected to claim 30 because of informalities. In response the Applicant submits herewith a version of the claims as currently amended and as previously amended, with brackets for all deleted material and underlining for added matter with respect to the original patent, in claim 30. The Applicant believes that the objections are overcome.

CLAIM REJECTIONS

35 USC 102(b)

Claims **7-9** and **30-33** were rejected under 35 USC 102(b) as being anticipated by US Patent 5,434,939 to Matsuda (hereinafter Matsuda). In rejecting the claims, the Examiner argues, in effect, that Matsuda teaches all features of the *product* recited in the claims. The Examiner argues that these claims are product-by-process claims and that patentability of a product by process claim is determined by the patentability of the product.

35 USC 103

Claims **1-6** and **10-17** and **30-35** and **39** were rejected as being obvious over JP 06-138341 to Konishi et al. In rejecting these claims, the Examiner argues, in effect that the differences between Konishi and the rejected claims would have been obvious to one of skill in the art.

The Applicant respectfully traverses all of the above rejections. In traversing the rejections, the Applicant respectfully submits that even if, arguendo, the rejected claims can be characterized as

product-by-process claims, process steps in a product-by-process claim may be used to distinguish the claims over the prior art. Specifically, MPEP 2113 recites:

> The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.)

In response, Applicant submits the rejected claims all recite "a fiber socket formed by masking and deep reactive ion etching to extend through said first layer". Applicant further submits that deep reactive ion etching (DRIE) would be expected to impart distinctive structural characteristics to the final product. These distinctive structural characteristics patentably distinguish the claims from the cited prior art.

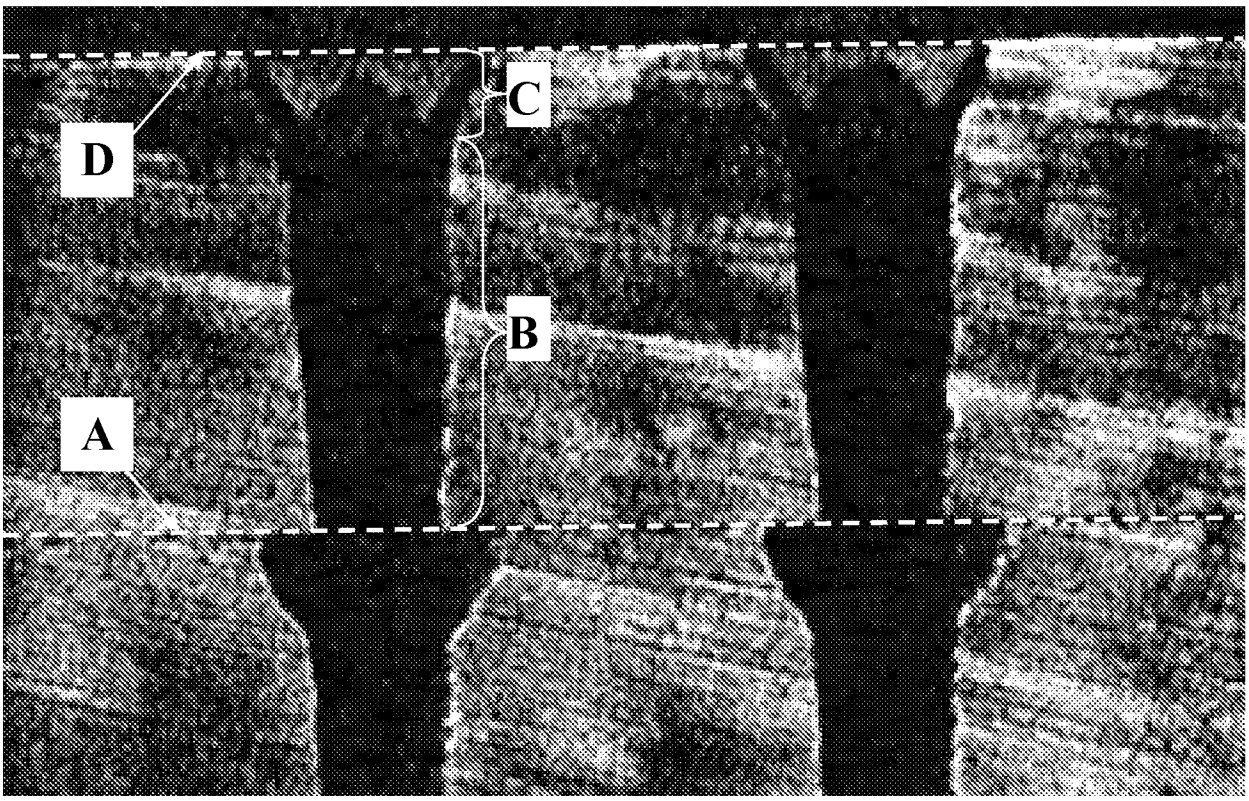
Specifically, the Examiner's attention is drawn to FIG. 3(B) and 3(C) of Matsuda. Note that Matsuda forms guiding holes 306 and through holes 307 through substrate 301 by an etching process. Matsuda very clearly teaches that the through holes are precisely positioned due a photomask used for opening both of the holes. Although Matsuda does not say so, it is clear that this photomask used to form the guiding hole 306 must be placed on the bottom surface of the substrate 301 due to the presence of epitaxial layers 302. It is further noted that Matsuda's guiding holes 306 and 307 taper from a slightly larger diameter at the bottom of substrate 301 (where the photomask would be located) to a smaller diameter proximate the epitaxial layers 302. This is consistent with a conventional (non-DRIE) process. If the guiding hole 306 is formed in this way, the more precisely defined part of the guiding hole is the wider end located near the photomask. However, as shown in Matsuda's FIG. 3(E) the fiber 310 is aligned by the narrower end, which is further from the photomask and, therefore, less precise.

The nature of this problem may also be seen from Drawing 3 of Konishi. Note that the etched holes 16 become narrower and less round as the etching proceeds deeper into the silicon single crystal plate 15 away from the mask apertures 19 in the masking film 18.

Thus, both Matsuda and Konishi very clearly teach a guiding hole that is less precise at the narrower end further from the mask side. Furthermore, both Matsuda and Konishi teach that the narrower, less precise, end of the guiding hole is the end used to align the fiber. So, the diameter and location of the narrow end are the critical dimensions which are difficult to control using conventional RIE processes. It is for this reason that fiber guide holes as taught by Matsuda and Konishi are often inadequate for precision alignment of optical fibers.

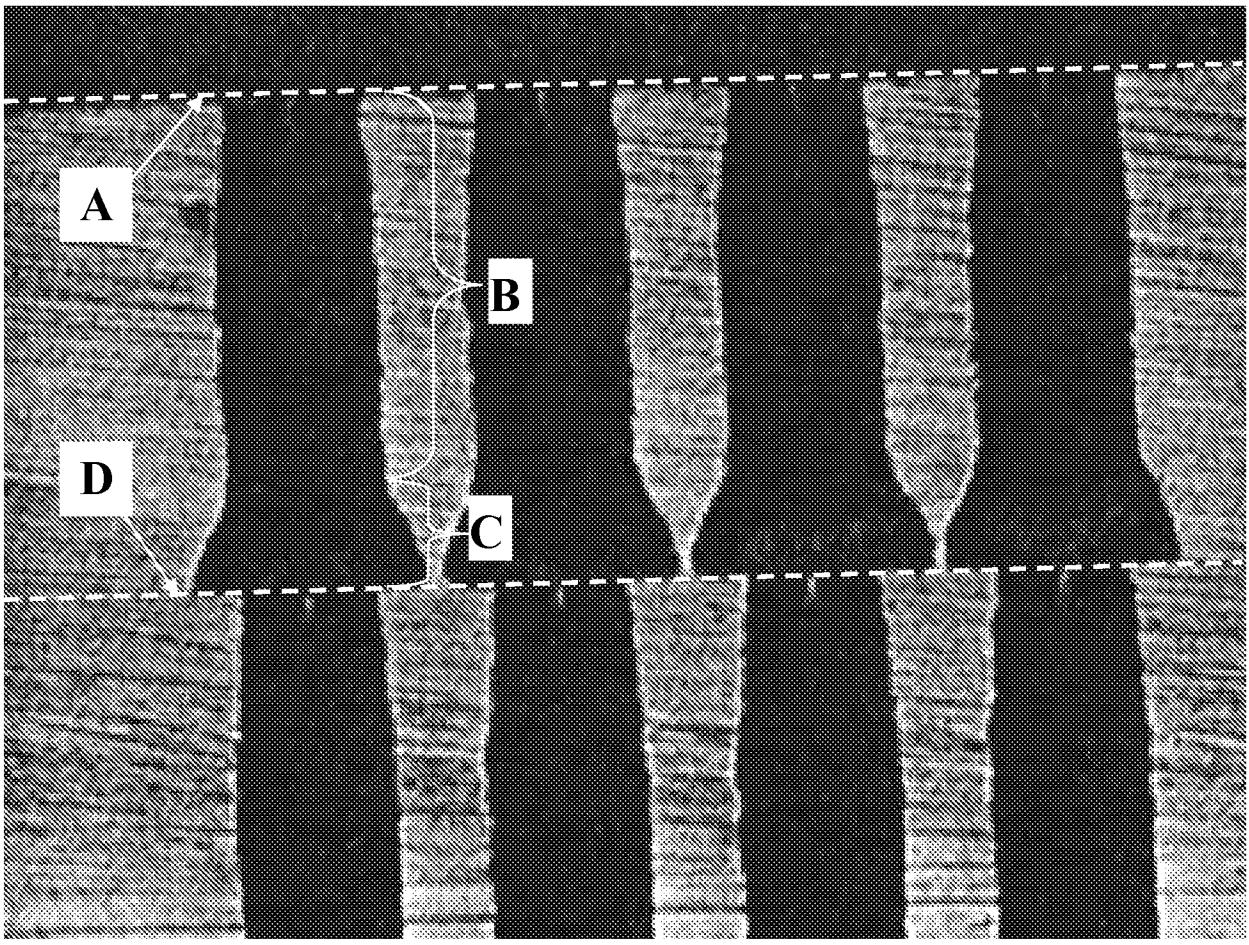
In embodiments of the present invention, by contrast, where the holes are formed by deep reactive ion etching, the type of tapering seen in Matsuda and Konishi does not occur. As shown, e.g., by US Patent 5,501,893 to Laermer at col. 5, lines 54-56, DRIE is characterized by a high mask selectivity, which greatly affects the structure of holes formed by this process. In fact, as a result of the high etch selectivity possible with DRIE the resulting hole either has vertical sidewalls or may actually be narrower (and most precise) closest to the mask.

This may be seen from the following images of structures containing DRIE holes taken by the Applicant:



In the above image two identical wafers with aligned holes have been permanently bonded together at an interface A indicated by a dashed line. The holes in the upper wafer include a DRIE segment B and a wet-etched segment C. These holes were formed by first performing a wet etch on the upper surface D, followed by a DRIE etch on lower surface A. An etch mask used to form a DRIE portion B in the upper wafer was located at the interface A. A mask used to form the wet etched segment C was located at an upper face D of the upper wafer indicated by a dashed line. Notice how the DRIE segment B is "reverse tapered", i.e., it is narrowest proximate mask face A and are wider further away from interface A. This narrowest portion of the hole is the part that provides fiber passive alignment and the location and diameter of the narrowest part are critical dimensions. With the reverse-tapered structure, this narrowest part is closest to the etch mask and therefore has the maximum fidelity with respect to the etch mask. Notice also that the wet etched segment C narrows further away from its mask face D, in stark contrast to the DRIE segment B. In this picture it may also be seen that wet etched segment C is pyramidal in shape like those shown in FIG. 3f of Konishi. The DRIE segment D, by contrast has a round cross-section.

These features are reproducible as may be seen from the following picture of a similar bonded wafer structure with similarly formed holes obtained in a different run with different wafers. In this picture, the DRIE etching used a mask at surface A of the upper wafer to form segment B. Wet etching formed segment C of the upper wafer with a mask at a surface D.



In addition to these photos shown, other researchers have obtained "reverse tapered" features using DRIE. For example the accompanying slides 13 and 14 taken from "Precision Microcomb Design and Fabrication for X-ray Optics Assembly Yanxia Sun, R. K. Heilmann, C. G. Chen, C. R. Forest, and M. L. Schattenburg, Space Nanotechnology Laboratory Center for Space Research, MIT, May 29, 2003", downloaded from the internet at:

"http://snl.mit.edu/papers/presentations/2003/YSun/3-beam-poster_v3.pdf#search=%22drie%20etching%22".

The micrographs in slide 13 show trench structures formed by DRIE with the same type of characteristic reverse taper seen in the above photographs. The process flow shown in slide 14 shows the location of the mask used to form the trenches. The trenches widen as the DRIE progresses further from the mask.

As may be readily seen from the above pictures and discussion, DRIE inherently produces a hole that is structurally different from that shown in either Matsuda or Konishi. Consequently, Neither, Matsuda, nor Konishi, either alone or in combination with each other or with skill in the art teaches all the structural features of claims **1-17**, **30-35**, **39** and new claim **40** and a prima facie case of either anticipation or obviousness is not present with respect to any of these claims.

Furthermore, if DRIE were to produce a tapered hole, that hole would be more precisely defined at the narrow end because it is the end closest to the etch mask, i.e., the end used to align the fiber. Applicant submits that a DRIE fabricated fiber socket will be precisely positioned exactly where the socket is used to align a fiber. It is for this reason that Applicant further submits that the structural difference associated with fiber sockets formed by deep reactive ion etching is the reason that the Applicant's invention:

1) Satisfies a long-felt, long-existing and unsolved need.
2) Succeeds where previously, failure prevailed.
3) Has achieved commercial success.

Evidence of these secondary considerations of unobviousness was presented in Applicant's Office Action response of February 24, 2006 and found persuasive by the Examiner with respect to claims **18-29**, **34-36** and **39**.

Furthermore, with respect to claims **2** and **40**, Applicant submits that deep reactive ion etching produces a hole having the type of precision needed for alignment of single mode fiber. Furthermore, for this very reason, Applicants invention as set forth in these dependent claims (a) satisfies a long felt, long-existing and unsolved need; (b) succeeds where previously, failure prevailed and (c) has achieved commercial success. Evidence of these secondary considerations of unobviousness was presented in Applicant's Office Action response of February 24, 2006 and found persuasive by the Examiner with respect to claims **18-29**, **34-36** and **39**. In particular, the Examiner's attention is drawn to pages 18-20 of the Office Action response of February 24, 2006 and documentary evidence referred to therein.

ALLOWABLE SUBJECT MATTER

Applicant appreciates the Examiner's indication of allowable subject matter in claims **18-29**, **34-36** and **39**. Although Applicant has amended these claims to remove the word "cylindrical", applicant submits that these claims still distinguish over the prior art cited by the Examiner. In particular, Applicant submits that the specification clearly defines a "fiber socket" as being a "vertical hole" (see col. 2, lines 65-67). While a vertical hole need not be cylindrical, it is certainly a different structure from the horizontal alignment groove 562 of US Patent 6,360,035 to Hurst et al. ((hereinafter Hurst). Applicant respectfully invites the Examiner to compare FIG. 4 of the present application with FIG. 16 of Hurst. The orientation of the fiber sockets 120 is very different from the horizontal alignment grooves Hurst shows aligning fibers 102.

CONCLUSION

The Applicant submits that all claims are allowable over the prior art and define an invention suitable for patent protection. Furthermore, the Applicant submits that none of the pending claims present an impermissible recapture of subject matter surrendered during prosecution. The Applicants therefore respectfully request that the Examiner reconsider the application, and issue a Notice of Allowance in the next Office Action.

Respectfully submitted,

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